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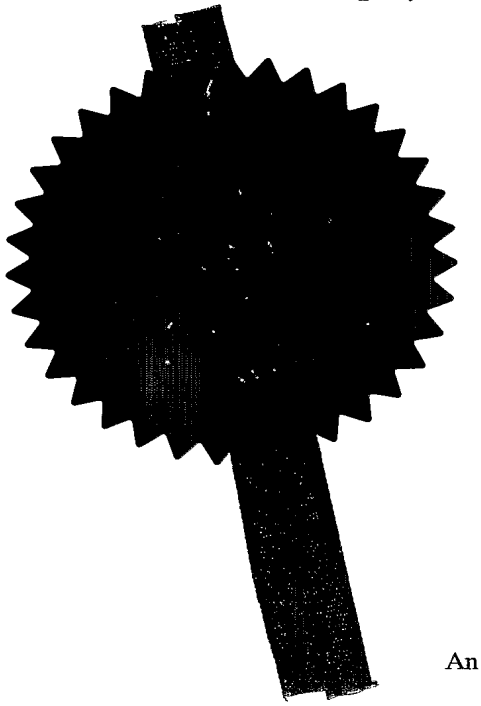

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1. Your reference M01XA/08

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3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

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4. Title of the invention MODULAR WRIST BASED HANDSET WITH DEMOUNTABLE EARPIECES FOR VOICE OVER IP AND MOBILE COMMUNICATION

5. Name of your agent *(if you have one)*

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Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*
UK	GB0406435.0	27/02/04

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MODULAR WRISTBASED HANDSET WITH DEMOUNTABLE EARPIECES FOR VOICE OVER IP AND MOBILE COMMUNICATION

CROSS REFERENCE TO RELATED APPLICATION

This application claims the benefit of and priority to a UK Patent Application No. GB 0404435.0 filed 27 February 2004, in relation to the Modular Interface Strap, the technical disclosure of which is hereby incorporated herein by reference.

BACKGROUND OF THE INVENTION

1) Field of the Invention

The invention relates to a portable modular wrist-based device that supports a plurality of removable electronic modules and forms a handset when open suitable for Voice over Internet Protocol or Mobile communication, and supports compact collapsible and demountable earpieces suitable for wireless audio usage.

Said modular device forms a wrist strap that is wearable as a wrist band and can be opened or deployed as a handset that is suitable for mobile communication, comprising a plurality of electrically connected nodes that act as docking points to mechanically connect removable modules, thereby enabling easy module substitution for preferred wireless or country specific mobile telephony connectivity, upgradeable data storage and battery modules, and personalisation of modules for consumer choice of alternate device features and ornamental style. Where said strap supports a plurality of wires on a flexible membrane and hub and host circuitry to enable network communication between modules via a universal bus and a universal connector plug within a locking clasp on the strap for external recharging and data-exchange when connected to an external device acting as host. The wrist strap supporting a microphone and a speaker at alternate ends, suitable for communication use when used on the wrist or in handset forms, and preferably supports compact earpieces that are demountable for wireless audio usage, where said earpieces are collapsible through mechanical and bi-stable material means. Said strap preferably also supporting a generic electromagnetic signal sensor, to indicate availability of signals for general connectivity and interest purposes. Said overall strap forming a portable communication device and being upgradeable to support a plurality of features via changing modules, where said modules can generally be removed from the strap directly when worn as a wristband or when the device is open.

A major problem with the consumer house-hold and office adoption of broadband Voice over IP at desktops is the non-availability or inconsistency in quality of microphone and speakers, as well as the difficulties in changing desktop phone behaviour, such that making a Voice over IP call to a third-party can be frustrating or impossible, and is generally restricted to certain guaranteed or reliable calls within an established peer to peer network, or when used by someone comfortable with their desktop microphone/speaker arrangement to connect to the external telecom network via a Voice over IP bridge. Similarly new cordless phone devices, that connect to a users desktop, require configuration, and are limited as with existing non IP cordless phones, to being custom devices that are not readily portable and usable across platforms, and generally require households to have

multiple handsets if they want quick access from multiple rooms, or to duplicate communication technology.

A major problem with the mobile uptake of broadband Voice over IP services via the traditional mobile phone is in part that commonly used VoIP codecs (such as H.323 or SIP protocols) run more reliably on consumer bandwidth links typically around 128 kb/s initially when compared to say GSM (which typically supports a dedicated voice or data call via a GSM specific codec over a 9600 bit/s digital link to a base station) or GPRS based telephony communication. This means that wireless VoIP services are generally only available at short-range at broad-band based wireless hotspots, or on higher bandwidth 3G type services. However, packet based communication via VoIP provides routing, switching, control and additional functionality (such as contextual telephony, where data and voice can trigger local information or database retrieval giving dynamic information relevant to the incoming caller) as well as being more economic as provide consumer choice and enable users to consolidate services for broadband internet access, telephony and media access. Early implementations also suffer from network delay, jitter when network traffic becomes an issue. Consumers can therefore be reluctant to substitute or duplicate their preferred mobile phone handset, with a device that only works in certain situations, and frequently defer upgrading/switching to hybrid VoIP enabled handsets until the technology is more readily available and reliable. Major commercial, monopoly and legacy reasons also slow down the rate at which major telecom companies provide handsets that are dynamically switchable between higher margined GSM/GPRS/3G services to nearby local wireless bandwidth hotspots or restrict access to preferred local wireless providers. This is in part as the local link could be provided by any third-party, as is currently emergent in the availability of 'free' wireless in dense cities by piggy backing on spare bandwidth within wireless hotspots. A result is that consumers may generally not replace their traditional mobile phone form-factor device with an equivalent VoIP enabled phone, or buy a dedicated VoIP phone until the technology matures and is more universal, despite the advantages in functionality and integration such systems can give, as well as the lower support costs in switching, routing and control technology.

Accordingly there is a need for an alternative platform that helps support faster migration to VoIP technology that provides VoIP or general communication via an easily portable handset device that can easily work with a nearby computer or base station, and is readily upgradeable to support better connectivity means as and when they become available and can be easily personalized to consumer technology and style values. There is a major benefit in this form-factor being different and wrist-based (using different 'body' real-estate) compared to traditional mobile phones, as consumers could be more likely to adopt a more portable wrist-based platform for VoIP whilst maintaining a separate phone, particularly for house-hold, office and general hotspot use which diverts to the cheapest available bandwidth supply, until such time as similarly compact mobile phone GPRS or 3G technology is available to warrant disposing of a separate mobile phone. Similarly early wrist-based GPRS/3G phones are likely to be bulky and face very short product life-cycles as they become rapidly obsolete in terms of size and features as new technology emerges, whereas a modular approach provides for device reuse and module extension at the logical economic and technological point.

2) Description of the Prior Art

Our priority patent application GB 0404435.0 sets out an assessment of various prior art on wrist watch devices and phones and discloses our modular interface strap architected as a distributed USB type hub for supporting a plurality of modules both electrically and mechanically. The prior art and commentary is largely incorporated herein. This application shows an embodiment of a modular interface strap formed to give a modular wireless phone handset in a deployed configuration and combined with demountable collapsible earpieces, along with an electronic hub circuit schematic and layout.

There is substantial and diverse prior art relating to instances of wrist-phone implementations, earphones in general, and wearable portable devices as dedicated or hybrid devices. However, no such prior art has all the features described and claimed herein, and in particular none describes a modular wrist strap architecture for supporting a plurality of devices and suitable for extendable wearable computing with third party devices. As an example no such examined prior art discloses a modular wristband assembly for mechanically and electronically connecting removable units, neither do they show a wristband device architected as a distributed USB ('Universal Serial Bus') Hub with nodes and electronics distributed in a linear and modular strap configuration to provide a plurality of mini-USB type connector docking points across a wristband strap. Nor do they disclose using such an architecture to enable a modular approach to wrist-phone and handset implementations that can be easily upgraded or customised to geographic and user preferences, or combination with demountable earpieces that can be conveniently stored on the wristband when not in use.

GB2364614 by Yong-Woo et al, (assigned to Samsung Electronics Co Ltd) describes a main instrument body containing a mobile phone with separate battery pack unit. Similarly U.S. Design Patent D466, 829 by Wada (assigned to Seiko) describes a typical design for a compact mobile wrist phone. U.S. Patent 4,847,818 by Olsen (assigned to Timex) describes a central main unit radio-telephone with wires connected through the strap to a connector clasp which contains a microphone and ear-piece at each end of the strap. Some prior art teaches distributing a phone, battery and electronic functionality across the entire strap to form a single overall device. E.g. U.S. Patent 5,872,744 by Taylor (assigned to Motorola Ltd), describes a generic design of radio-telephony device where a main unit is connected to a series of hinged battery units or PC-boards that form the overall strap. U.S. Patent 6,212,414 by Alameh et al (assigned to Motorola Inc), filed April 1999 similarly describes a general approach for a dedicated radio telephony device which distributes battery and electrical components throughout the strap in order to reduce the size and electronics in the main unit which in this case is partly detachable, as well as suggesting potential incorporation of a recharging jack in the strap clasp. U.S. Patent 5,265,272 by Kurcbart describes a strap design that is assembled by interconnecting strap/chain units (similar to a traditional jewellery band or metal watch chain strap) that form both a strap and could carry electrical connectivity and loop antenna suitable for incorporation with a central unit.

Examples of prior art with central main units linked to distributed strap units include the watch device US 6,619,836 by Silvant (assigned to Swatch), WO9832057 by Caballe which describes a main unit instrument body with separate detachable modular side unit that connects directly into the main unit. WO0038393 by Fourie describes a generic design for a central watch/main processing

unit, with additional detachable modules arranged around a strap. US 4,586,827 by Hirsch describes a wiring approach for a wristband information system where a central unit attaches mechanically to a plurality of wires in the strap, enabling the wires to act as antenna or connect directly to additional PC-board modules at different points of the strap. US 6,619,835 by Kita (assigned to Casio), filed May 2001, discloses a similar wristband system with a central unit connected to a custom removable strap containing wires which branch either side of the main unit and support extendable memory modules on one side and sensor modules on the other, controlled by circuitry in the central module, where said strap being unplugged from the central unit in order to slide on or change modules.

Examples of prior art on earphone devices include US 5,239,521 and US 5,381,387 by Blonder, where a fold out section of the strap provides a microphone or speaker. D380,476 by Zochert discloses a retractable earpiece attached to a phone, and US 5,5467,324 by Houlihan shows a similar deployable voice-port. Similarly US 6,757,389 and US 6,035035 by Firooz shows a further example of deployable voice-port or fold-out mobile handset. An earlier patent, US 5,008,864 by Yoshitake, discloses the general principle of using a wrist-device as a wrist phone and handset, similarly US 6,529,713 by Seymour (assigned to Nokia), discloses a specific design of wrist-phone where a whole handset is demountable from the strap.

In reference to the demountable earpieces, no such prior art examined has all the features described and claimed herein, and in particular none describes the combination with a modular architecture, where said earpieces are designed to be compact by collapsible and bi-stable material means, and due to modularity can be readily substituted with user preferred earpiece forms and sizes. Neither do they disclose the convenience of using a USB type hub and network approach to allow multiple vendors to readily integrate suitable modular components that could provide firstly a USB wireless link for Voice over IP wrist-phone usage in proximity to a nearby base station, a Bluetooth or WiFI wireless linkage module for short range connectivity, and ultimately a GSM, GPRS or 3G module to provide connectivity for VoIP or general mobile communication in general.

To the best of the applicant's knowledge, the prior art, whilst suggesting some features and numerous variations of wrist phones and wearable devices in general, the prior art has not disclosed some of the highly advantageous features of the present invention discussed herein.

SUMMARY OF THE INVENTION

The main object of the present invention is to provide a modular wrist-phone that can be used as a generic portable handset for Voice over IP or mobile communication, or used on the wrist in conjunction with demountable wireless earpieces or microphones that are conveniently stored on the wrist-band when not in use, with the overall device being easily upgradeable to support new forms of connectivity as and when they become available within the users environment, by utilizing an extendible modular architecture that can readily electrically and mechanically support new modules via a common integration standard.

The wearable modular wrist strap, of the present invention, in a preferred embodiment comprises a substantially flat flexible strap that forms a wrist strap secured by a clasp that is wearable as a wrist band and can be opened or deployed as a handset that is suitable for mobile communication, where said strap supports a plurality of electrically connected nodes which act as connecting or docking

points for securing multiple removable module units. Said nodes being connected by a plurality of wires within the strap and preferably arranged in a longitudinal direction and containing connectors acting as a serial bus to enable electronic data and power connectivity between the strap and the attached module and containing local resistors, circuitry and capacitors within the node unit to facilitate hub port functions and power management such as limiting downstream current surges when hot-attaching a module. Said nodes providing a mechanical clip mechanism to securely lock modules in place and a release mechanism to enable modules to be removed through a lateral sliding motion or changed without having to remove the wristband, and preferably a sprung positioning pin that could optionally be replaced with a screw accessible by removing the wristband for additional fixing. Said strap being affixed to a joiner clasp unit at each end suitable for easily securing the strap together at each end of the wristband when worn on the person, and containing a mechanism at one end for varying the length of the strap. Said joiner clasp connecting the strap wires to a universal serial bus or fire-wire type connector plug contained within the clasp and suitable for connecting the overall strap when open to a connector or port on an external device to facilitate data exchange, communication and power recharging. Said clasp containing suitable embedded host, hub electronics, clock and controller chips to manage connectivity to and between each of the individual connecting nodes and modular devices attached to the strap such that the strap can function both as an interface hub with multiple ports when open and used with an external host, and as a personal wristband network with local host functionality when closed.

The wrist strap supporting a microphone and a speaker at alternate ends, suitable for communication use when used on the wrist or in handset forms, and preferably supporting compact earpieces that are demountable for wireless audio usage, where said earpieces are collapsible through mechanical and bi-stable material means. Said strap preferably supporting a generic electromagnetic signal sensor, to indicate availability of signals for general connectivity and interest purposes.

Said overall strap forming a portable communication device and being upgradeable to support a plurality of features via changing modules, where said modules can generally be removed from the strap directly when worn as a wristband or when the device is open. Said modularity thereby providing an easy method to customise the device for country or user specific mobile telephony connectivity and to provide the user with freedom to upgrade data storage and battery modules, and to personalise the wrist based device for new and alternate device features and consumer choice on ornamental style.

Said removable modules would generally consist of at least a central unit capable of displaying information, a combined or separate unit suitable for control as a user interface, a rechargeable battery unit or element within another module, and functional units for data storage, communication, external sensing and other electronic devices. Said removable module units could also consist of a dummy or filler cover unit suitable for covering the docking point where no functional unit was attached, and used largely to provide personalised ornamental design or simple patterned light effects across the strap. Said functional units could optionally contain additional advanced power management circuitry and capacitance depending on the requirements of the module as well as local memory, battery units, displays and interfaces.

Said overall wrist based device being connectable to a cradle or desktop station by means of the universal connector for power recharging, and local functions where said cradle might connect to

additional nodes for spare modules or mechanical racks for storing unused modules and filler cover units. Said strap being available in different initial lengths to provide for a range of human wrist sizes or preferences.

Said overall wrist-based device, in a preferred embodiment uses a Universal Serial Bus connector as the connector plug, and USB 1.0 or 2.0 specification compliant Host, Hub controllers and circuitry in the clasp, with suitable power management circuitry and capacitance at the nodes acting as individual serial bus ports, with the four connectors within each node and associated wiring being two of power (a ground line and a Vcc line at +5v) and two of data (a serial data line and clock line), which preferably uses the standard NRZI (Non Return to Zero Invert) encoding scheme to send data with a sync field to synchronize the host and receiver clocks in the usual manner. Alternatively a similar implementation could be achieved using a Firewire Serial Bus system or other Serial Bus or simple Ethernet approach.

In a preferred embodiment when said overall modular wrist based device is open and connected by means of the clasp USB connector clip to an external USB port, the external device would take on the role of USB host, whereas when the device is closed and used as a wristband it would act as a local host, using the circuitry on the clasp hub controller and/or circuitry embedded in say a single central interface module, to allow intra-module communication and data exchange. The new USB 2.0 specification provides for greater design freedom in implementing more complex host functionality via the On-The-Go specification which introduces a host negotiation protocol, more options for embedded host and controller design, and there is also design flexibility from the original UHCI (Universal Host Controller Interface) and OHCI (Open Host Controller Interface) specifications as to the degree to which any advanced local host functions required are embedded in single hardware controller chips in the clasp and/or module circuitry or as software drivers in say a more advanced central control module. Similarly some modules could use a Wireless USB chip to facilitate easy wireless communication with the strap hub and network.

A major benefit of the overall wearable modular strap using the USB or fire-wire standard is that each third-party module can follow a traditional architecture for serial bus communication, greatly facilitating the flexibility and integration of third-party module design as well as to provide a common method of data exchange using say a preferred token-based protocol for any device on the wristband to access and use resources such as display/control/memory from any other attached module device. Additional circuitry could be added to the controller chip in the clasp to provide additional inter module functionality, such as a common store of connected devices and resources and additional buffer memory, or such circuitry could be embedded in a central display or interface unit configured to act as a local host. USB offers greater freedom in power management and a key advantage of our modular wristband device enabling physical connection with wearable devices, is that devices can be attached and recharged, whereas wireless devices whilst able to exchange data cannot exchange power wirelessly, so always need to be recharged.

Modules can be attached to a single node, or optionally a larger combination module could be attached and affixed on two connector nodes by sliding laterally as with a single module, with at least one connector acting for electrical and power connectivity. Such a module could be used as a central unit with advanced processing or large-scale electronics as miniaturization of radio-telephony devices and other advanced modules such as 3G may take some time. Equally a

combination unit could provide scope for selecting a display, control and interface design from a preferred supplier or brand. Similarly a device could be pre-shaped into a curved form and physically attached to more than one node.

The modular approach therefore provides an extendable architecture for customizing both the appearance and function of advanced electronic wrist-based devices by providing a common modular framework for electrically and mechanically supporting a plurality of new devices, and to enable the customer rather than the supplier to select the features, functions and specification they desire as new modules become available as well as customize the overall appearance to individual style and fashions.

Similarly there is an advantage in such a wrist-based device supporting demountable earpieces or microphones, as they can be easily changed for user preferences, and stored and recharged from the main wrist-strap power source when not in use. Similarly wireless earpiece use in conjunction with the wrist-based device provides for easy use in leisure and vertical applications, such as when walking, running, cycling, where a user could simply remove an earpiece from the strap and position it in an ear, for communication or music player (such as MP3) purposes.

Similarly multiple wrist-straps could be used by an individual to support additional features, and optionally battery packs, with intra wrist strap communication provided by the wireless USB protocol. This would be particularly relevant when travelling as users could carry additional batteries or storage, which might be relevant when say using a camera module. Likewise a module with removable lid could be produced which could hold a disposable battery or a battery could be custom produced with an equivalent receiving docking port such that it could be simply plugged directly onto the node on a strap.

A key benefit of the modular wrist strap approach compared to existing prior art devices that focus around delivering a single device or dedicated main body/strap is that there are many potential wristband technologies, suppliers and third-party devices emerging with different product cycles which will take time to stabilize and be aggregated into single custom wristband devices, however, for the modular approach these emergent technologies could be incorporated faster as individual modular units as and when they become available, enabling a faster and more economic take-up by the consumer. Examples include compact data and media storage and players for MP3, wireless communication devices such as Bluetooth as well as compact radio-telephony units, digital radio, health/environment sensors, security tags, location sensors, cameras, microphones, flexible fold out screen displays, removable wireless earpiece connectors.

A further benefit of the modular approach is that it avoids the wasteful and rapid obsolescence of technology where users have to replace an entire wrist watch device to upgrade to a better specification or add a new function. This is likely to be of increasing benefit as environmental considerations raise user awareness about wasteful product cycles. An example of this is perhaps the short-lived product cycle for single unit camera watches which were largely superseded by mobile phones which incorporated camera elements, whereas a modular approach could have allowed adding a mobile unit, advanced camera or additional memory as and when the user required it and to their desired specification, or to replace a device with a smaller less clunky unit, which is a buyer value as technology miniaturizes. A further example is to avoid the problem of overall device

obsolescence when a component fails or reaches its maximum lifetime (e.g. a battery with limited number of recharges), which could simply be architected easily as a removable or upgradeable module. This helps address some of the design compromises made when launching a short-lived dedicated device, such as using available battery, storage or display technology which rapidly becomes obsolete, or where said technologies develop faults requiring replacement, which can be expensive in a highly compact dedicated device. The modular wristwatch strap is therefore expected to be a personal wristband which provides continuity across a range of devices the user selects rather than a single purpose product and therefore potentially has a longer product lifecycle than some individual module components.

Of particular benefit is the ability the modular strap offers for users to exchange modules with colleagues, or to possess additional modules and to adapt the wristband depending on their activity. By way of example a user might use a docking cradle at home to store a plurality of modular devices, and substitute a memory unit with say a GPS (Global Positioning System unit) when they go jogging, or to add a compass/emergency unit when they go camping. Similarly users could use the strap to store wireless electronic keys, perhaps in combination with a biometric security identifier such as a thumb pad. In a corporate context, users could carry project based data banks or security tags on the strap and exchange modules containing secure information or receive a welcome module with data when arriving at a location. Similarly conferences and retail stores could distribute modules containing custom data such as a sales material or conference packs, or sell music and media as an instant unit which could be attached to the wristband. In a vertical application such as a hospital or nursing home, health sensor modules could be added to monitor particular characteristics as and when they are needed, as well as being able to substitute the communications module with an appropriate technology that works in that environment, office or country. Modules could also be recycled or sold when they are no longer needed by users.

Similarly a user might possess a compatible necklace or pendant strap and be able to substitute modules as they desire, with similar strap configurations being possible on a belt, in isolation as a cufflink or button when combined with an embedded wireless device, or as part of a sunglass frame side.

Accordingly the overall wearable modular wrist strap device could therefore transform the wristband into a truly viable multi platform for portable wearable computing and communication which could be adapted by the user for their specific functions and aesthetics.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate presently preferred embodiments of the present invention and together with the detailed description serve to explain the principles of the present invention.

FIG. 1 shows a three dimensional view of the wrist-based handset in a closed configuration, as it might appear on a wrist, with FIG 1A showing a wristband containing a full assembly of modules, FIG 1B a wristband strap with no modules and FIG 1C a side elevation view through the wristband.

FIG.2A shows a three dimensional view of the overall wrist-based handset in an open configuration as a handset, with FIG 2B showing a side elevation.

FIG. 3A shows a three dimensional exploded view showing the key components making up the overall modular wristband device assembly, with some modules removed. FIG 3B shows a cross-sectional exploded view through the wristband strap and connector node.

FIG. 4A shows a three dimensional view of the overall wrist-based handset showing a demountable earpiece and a module removed. FIG 4B shows a cross-sectional view through the strap and example module.

FIG 5 shows a sketch of a person holding the deployed handset

FIG 6 shows a three dimensional view of an embodiment of a demountable earpiece being attached to the wrist strap and in use, with the earpiece supporting a fold out ear clip.

FIG 7A shows a further embodiment of a demountable earpiece incorporating a flexible or bi-stable material for the earplug. FIB 7B shows a further embodiment formed as an earplug.

FIG 8A. shows an exploded view of a wristband strap docking point and electrical and mechanical connector clips as well as an explosion of an example module. FIG 8B shows an enlarged 3D view of the base of an example module.

FIG 9. shows a plan view of a strap locking clasp in an open configuration with the top sections removed for clarity with the lower image showing an exploded view of the individual components.

FIG 10 shows a high level electronic architecture for circuitry forming the wrist-based Hub and network

DETAILED DESCRIPTION OF THE INVENTION

A preferred embodiment of the invention will now be described with reference to the accompanying drawings herein:

Referring to FIG. 1A, which shows a 3-dimensional profile of an overall modular wristband device 1 in a closed configuration which comprises a flexible strap 2 connected to a clasp 73 which joins alternate ends of said strap so as to form a loop, where said strap 2 contains a plurality of removable modules 5 arranged at preferred regular intervals around the strap and secured by means of docking points or nodes 4 which serve to electrically and mechanically connect the strap 2 with the modules 5. FIG 1B shows a 3-dimensional profile of the wristband with all modules removed and more clearly shows the arrangement of docking nodes 4 in around the strap 2, along with an alternative fold out design clasp 3 of clasp 73. FIG 1C shows a side view of said modular wristband device 1, showing a main control module 72 with side control buttons 74.

Referring now to FIG 2A, which shows a 3-dimensional profile and FIG 2B a side profile of the overall modular wristband device 1 in an open configuration forming a curved handset and supporting a removable central module 72 preferably with touch sensitive screen face 75, and side

buttons 74, and removable modules 77, 76, 78, 80 which by way of illustration correspond to a battery and earpiece unit 77 with demountable wireless earpiece 79, a data storage module 76, a wireless connectivity and sensor module 78 supporting LED indicators 86 to show the strength of various signals that could also act as selector switches, a microphone and battery unit 80 supporting a demountable button microphone clip 81. The joining clasp 73 can be seen to be made from a female unit 85 and male unit 83 which contains a typical connector such as a USB jack 84 as well as hub and host control circuitry (See FIG 10). Similarly circuitry and battery capacity could be located in the female clasp 85.

Referring now to FIG 3 which shows an exploded view of the overall modular wristband device 1 and breakdown of the strap 2, docking node 4, module 8 and example clasp 3 components in more detail. The Strap 2 comprises a top outer layer 13, an internal electrical membrane layer 14 and inner layer 16. Said top outer layer is made from a flexible material such as rubber or plastic and contains holes 30 at regular intervals with a partial ledge 70 and connecting to an external connector 19, which in a preferred embodiment is a USB connector 19, and supports circuitry 20 that contains at least one hub controller chip and preferably an embedded host, and a plurality of resistors and other control circuitry. The middle layer 14 is a flexible membrane containing a plurality of wires connecting the connector 19 to the individual node circuit boards 15 arranged at regular intervals and capable of being assembled by sliding up through the holes 30 in the top layer 13 and affixing to the ledge 70. The lower layer 16 is a flexible or rubber material which affixes within the recess formed on the bottom face of the top layer 13 and affixes to the bottom face of the membrane 14 and optionally through holes at intervals in membrane 14 to affix directly to the bottom face of 13. Optionally this layer 16 could be biased by means of sprung metal to adopt a preferred curved form on opening either as a complete section or as sub-sections, generally achieved through performing or annealing material during manufacture. Said node circuit boards 15 support and electrically connect additional capacitors 59 and chips and resistors 60 suitable for local power management functions, and four electrical connector prongs 61 (as can be more clearly seen in FIG 8) as well as a locking hole 62. Said node circuit board 15 is preferably of rigid or semi-flexible material. Said node circuit boards 15 have a corresponding cover 12 made of a rigid or semi-flexible material that covers the circuit board and said capacitors 59 and chips 60 as well as provides slots through which the electrical connector prongs 61 protrude. Said cover also contains a rigid vertical prong 67 with shaped edges that serve to secure the modules 8 in place when connected. The overall assembly of cover 12 and circuit board 15 on the strap layers 13, 14, 16 thereby form the docking node 4 which serves to both mechanically and electrically connect to modules 8. A positioning pin 17 is also shown which would affix through holes 43 in the lower strap 16, and circuit board 15 hole 62 and cover 12 into the module. Such a positioning pin 17 would have a biased triangular bevelled end (Not shown) and be sprung such that it would compress when the overall module 8 is slid laterally, or be replaced with a small screw where modules are to be attached in a more permanent fashion in a screw thread within the module cylinder 57 (See FIG 8).

FIG 3 also shows the components of a locking clasp 3 which on one side has male 6 unit comprising a lid 18, USB port 19 (or 84) and circuitry 20 and base unit 21, and on the other has a female unit 7 formed from a lid unit 22 which is hinged and attached to base unit 23 as will be more clearly seen in FIG 9. Also shown are general example modules 8, a display module 11 and an example ornamental filler cap 9. Similarly said clasp could be shaped as in clasp 73 (FIG 1) with a male component 83 and female component 85, and be fastened by a push or clip action.

Referring now to FIG 4A which shows a three dimensional profile of the overall modular wristband device 1 in an open configuration forming a curved handset and supporting a removable central module 72 preferably with touch sensitive screen face 75, and side buttons 74, and removable modules 77, 76, 78 and 87 (representing a generic accessory module such as a health sensor), where earpiece 79 is shown demounted from its module 77 and shows an ear-clip 89 and audio earplug 88 that has sprung folded out from the module. Similarly module 87 is shown removed from the strap node 4 and could be substituted for another module. The control module 72 shows a screen 75 which could be formed from LED/LCD or OLED display technologies, and preferably supports a capacitive touch sensitive roll area. FIG 4B shows a cross-section through the strap 2 showing the layers making up the overall docking node 4 which will be more clearly seen in FIG 3B and FIG 8, and a dotted cross-section showing the profile of an example attached module 8.

Referring now to FIG 5 which shows a consumer holding the deployed handset 1 as it might be used , where fingers can easily access side-buttons 74 on the central module 72, and screen 75 could be used to dial graphically displayed numbers, or select a caller from a list of ids.

Referring now to FIG 6 which shows an embodiment of a demountable earpiece 79 removed from its module 77 which remains attached to the wrist strap 1. FIG 6B shows a reverse side view of the wireless earpiece 79 showing the fold out earplug 88 and foldable ear-clip 89, both of which would be sprung so that they pop into place when the earpiece 79 is removed from its module port 77, and which would be folded back into place by the action of securing the earpiece 79 back in its module port 77. FIC 6C shows how the device might appear when attached to an ear 90. Similarly the microphone button clip 81 attached to module 80 (in FIG 2A) would be demountable and usable in a similar way. Earpiece casing 79 would support a rechargeable battery and wireless connectivity circuitry (such as Bluetooth or USB Wireless) to enable short range connectivity to the wristband worn on the person, with connector nodes (not shown) that would link to connector nodes on the module port 77, that are directly connected to the Strap port node 4, to enable data exchange and recharging.

Referring now to FIG 7 which shows alternate embodiments of demountable earpieces in FIG 7A and FIG 7B. FIG 7A shows an example of a miniature earpiece 91 secured in a module 93 supporting grooved recesses 92. In this embodiment two earpieces can be secured on a single module, suitable for left and right ear audio purposes. The reverse of an earpiece 91 supports connector ports 94 for recharging purposes and would use a wireless chip embedded in casing 98 for data and audio connectivity with the wrist-strap device 1, and would contain a rechargeable battery unit embedded within the casing 98. In this embodiment the earplug is preferably formed from a bi-stable elastic and rubbery type material that is biased to fold up along a hinge line 96 and form a cylindrical shape 95 when deployed that can conveniently secure the earplug within the ear. Said earplug 95 could be biased by means of the elastic composition of the material and optionally integral fibres having different tensile and compressive strengths. The earplug thereby forming a flexible cylinder that could be adapted for a range of ear sizes, and being easily flexible to store in a compact a generally planar form when the overall earpiece 91 is positioned within the grooved recess 92 on the module 93. FIG 7B shows a further embodiment of a demountable earpiece 100 comprising a solid rubber earplug 101 positioned within a module 99. The modularity thus allowing a wide range of earpiece forms to be selected by the user and stored conveniently on a wrist strap.

Referring now to FIG 8 which shows an exploded view of a module 8 attached to the strap 2 and the components making up the strap docking node 4. The generic module 8 is positioned over the vertical prong 67 of the node 4 circuit board 15 and cover 12 by means of a slot 55 in the base 53 of the module 8. The act of pushing down the module has the effect of sliding the sprung locking bar 51 slightly as it makes contact between the curved edge form of the vertical prong 67 and the underside curve on the locking bar 51 without need to press the release button 52. The locking bar 51 position has a side profile 50 that then corresponds to the side profile of the vertical prong 67 such that the module can be slid laterally onto the rails 58 in the module base 53 which securely fasten the module to the strap node unit 4 by means of the edges of the vertical prong 67. The locking bar 51 then springs back locking the module 8 to the strap such that it cannot be removed unless the release button 52 is pressed and the module slid sideways and lifted off. Once the module is in place the sprung electrical connectors 61 on the node circuit board 15 make contact with reciprocal connectors on the base of the circuit board 47 by means of a recess 56 in the module base 53 in a similar manner to a flash or phone SIM card. The vertical positioning pin 17, can also spring into place through holes 62 and 43, to provide additional stability or be replaced with a locking screw if required. The overall rectangular shape of the vertical prong 67 and hole 55 combined with the locking bar 51 is designed to provide rigidity to the module such that it won't twist or shear once in place on a wristband. An example circuit board 47 is shown covering the majority of the area of the module and supporting a plurality of chips 48 and containing a slot 49 for the module locking mechanism and node prong 67. Optionally the circuit board could support additional advanced power management circuitry such as larger capacitors, should the application require it. An example module lid 46 is also shown, though in practice this could be a screen, as in module 11 or a form of interface as in module 10. The module could be of different size or shape and is only limited by the spacing between docking nodes 4 on the strap and the fastening mechanism components 55, 58, 51. It will be appreciated that the lateral sliding fastening mechanism illustrated here as a preferred configuration could be adjusted in dimension or reformed as a rotational sliding or vertical locking mechanism, similarly the locking bar could be likewise adjusted. FIG 8B shows an enlarged view of the module base 53 showing the underside surface 54 and the internal structure more clearly showing the hole 55, locking rails 58 and side profile 50 of the locking bar 51.

Referring now to FIG 9 which shows a more detailed plan and exploded view of a clasp 6 mechanism, with the top diagrams showing a plan view of the open clasp and with the top lids 22 and 18 removed for clarity. This diagram more clearly shows the side button 39 on the top lid 22 of the female clasp 7 and the prongs 40 which would spring back slightly as it is pushed into the recess 41 in the lower base 23. Also shown is the hinge 38 between the upper lid 22 and the strap connector block 37 which attaches through the strap 2 to the base unit 23 by means of locking bolts 33 that pass through holes 34, 35 and 36 respectively. The oblong nature of the holes 35 in the strap provide one method of varying the length of the strap slightly as might be required by the user. For longer variations in strap length other straps could manufactured at different lengths with different hole 35 spacing or alternatively manufactured with one end being formed of plastic/rubber suitable for being cut down at point of supply and then connected to the clasp 7 in a similar manner. The hinge 38 on the strap connector block 37 could optionally be formed in the mould itself such that 22 and 37 form a continuous structure joined by a thinner more flexible plastic which would directly provide a small spring action, or could be a metal or other direct hinge. Similarly buttons 39 and prongs 40, could be formed as a continuous structure with the spring action created by a smaller width of plastic at the

hinge axis. The overall outer surface of the clasp 6 and 7 is of a preferred rubber texture. The lower image shows the female clasp lip 45 and the male tongue 44 on the base 21 of clasp 6 lower which facilitates connecting the clasps together before the clasp is locked or released. An example circuit board 42 containing at least one integrated embedded host and hub controller chip 20 attached to the USB connector 19 is also shown and would be connected directly to the internal strap membrane 14 for connectivity through to the individual docking nodes 4 and circuit boards 15.

Referring now to FIG 10 which shows a high level electronic schematic for circuitry forming the wrist-based Hub. FIG 10A shows example wiring that would form the flexible electrical membrane layer 14, connecting the clasp circuitry 20 to individual node circuit boards 15, which in this case represent six USB ports, U1, U2, U3, U4, U5 and U6. FIG 10B shows an enlargement of an example PCB making up an individual circuit board 15, which supports connectors (e.g. 115, 116) on the underside to permanently connect to the wire ports on the flexible electrical membrane 14 and internal circuitry for power management and voltage regulation 60 by means of local capacitors 59, encased within the node cover 12 and vertical docking node prong 67 and four metal USB connector prongs 61 that form the downstream USB port to electrically connect to external modules 8. FIG 10 C shows an example removable battery module 102 that supports additional power management circuitry by means of a regulator 104 and switch 105, to mitigate power surges when connecting the module via the USB connector 117 to prongs 61 on the strap and circuit board 15. Preferably said battery module 102 would contain circuitry to help manage complex power management between multiple battery modules, and embedded batteries within other modules and the clasp, as well as switch into a charging mode when the overall wrist-strap is attached to an external host or recharging cradle. FIG 10 D shows an enlargement of an example circuit forming the clasp circuitry 20, and comprising a hub controller 106, an embedded host 107, and power regulator circuitry 108. Said embedded host 107, would dynamically switch control to an external host when connected via the USB upstream port 19, using mechanical or software means (such as via the USB On the go protocol). Said USB upstream port containing 4 wires, being for example 109 for VBus, 110 for data, 111 for clock and 112 for ground. Optionally overall circuitry 20 could be distributed via flexible electronics within the strap 14, or at the opposite end of the strap and embedded within the female portion 85 of the joining clasp.

Although the invention is described and illustrated with reference to one preferred embodiment a wrist-based handset device it is expressly understood that it is in no way limited to the disclosure of such preferred embodiments, but is capable of numerous modifications within the scope of the claims. By way of example the strap could be produced with a different number of docking points at different spacing, similarly the docking point could be used in other wearable devices such as on a pendant, belt or directly on clothing. By way of further example the mechanical docking point could be implemented in a rotational manner, or as a vertical release mechanism, and various other serial bus and network protocols could be employed to manage data exchange between nodes and modules.

CLAIMS

What is claimed is:

1. A modular wrist based device that is deployable as a handset suitable for mobile communications comprising;

   a flexible wearable strap supporting a plurality of mechanical and electrical interface docking points that are capable of supporting several removable modules

   a strap connected to a clasp at each end to close and fasten the overall device as a loop, which contains a plurality of wires which electrically connects each of the said docking points to an external connector embedded within said clasp and circuitry to enable data communication between docking points and attached modules

   docking points that provide a mechanical mechanism to enable said modules to be easily attached and removed without opening the strap, and an electrical mechanism and circuitry to enable power and data connectivity with an attached module such that it could be removed or attached without electrical disruption to other modules

   removable modules which are capable of providing a plurality of electrical device functions that could act to provide communication functions, rechargeable battery power, display information, act as control circuitry, act as data storage, act as a user interface, perform external sensing and be extendable for other functions

2. A modular wrist based device according to Claim 1 where said strap supports at least one earpiece and at least one microphone suitable for the overall device to be used for communication purposes either when worn on the wrist or when open and deployed as a handset, with at least one module with a demountable earpiece that connects using a wireless link to the wrist strap device

3. A modular wrist based device according to Claims 1 or Claim 2 which supports at least one removable control module with display and interface, at least one removable audio enabled module, and at least one removable connectivity module, suitable for the overall device to be used for Voice over IP or mobile communication

4. A modular wrist based device according to Claims 1 to 3 where said electrical interface between strap docking point and module is a serial bus interface comprising at least four metal prongs for power, ground, data and clock line connection between wires in the strap and circuitry in the module

5. A modular wrist based device according to Claims 1 to 4 where said overall device can act as a hub when open and connected via an external connector for the purposes of recharging and data-exchange with an external host device, by means of control circuitry in the clasp, and local control circuitry attached to each docking point

6. A modular wrist based device according to Claims 1 to 5 where said overall device can act as a local network when not attached to an external device for the purposes of data-exchange and for access to resources on modules attached to other docking points on the strap, by means of embedded host control circuitry in the clasp and local power management circuitry in the docking point and attached modules.

7. A modular wrist based device according to Claims 1 to 6 where mechanical means in the docking point and module base enable a module to be slid laterally and locked into position on the strap without removing the strap from the person

8. A modular wrist based device according to Claim 7 where said module locking mechanism is accomplished by means of a locking bar in the module that has an underside profile that matches a vertical prong profile on the strap docking point and the module has a hole and adjacent locking rails that secure the vertical prong when the module device hole is positioned down over the vertical prong and slid laterally. Said sprung locking bar being displaced by the action of positioning and sliding the module over the vertical prong, which then springs back locking the module in place, and releasable by means of an external button

9. A modular wrist based device according to Claims 1 to 8 where said docking point is assembled in layers comprising a circuit board electronically connected to a wire membrane in the strap and a cover for encasing local circuitry, chip and capacitance, where said cover contains a vertical prong shaped to be suitable for mechanically connecting to an attached module

10. A modular wrist based device according to Claims 1 to 9 where said strap is assembled in layers from an upper layer that is semi-flexible containing holes to support the docking point circuit boards, and a flexible interior membrane layer containing wires connecting to an external connector in the clasp and connecting to and supporting the docking point circuit boards, and a lower layer for sealing the whole unit as a strap.

11. A modular wrist based device according to Claims 1 to 10 where said clasp is formed from a male component containing a universal connector, control circuitry and chips, and a female component comprising a lid and lower base unit, where said female clasp contains a locking block for attaching to the strap at various points and thereby varying the strap length

12. A modular wrist based device according to Claims 1 to 11 where a module contains at least a locking mechanism suitable for connecting to the docking point, connector plates for connecting to the four metal serial bus connectors on the docking point when the module is attached, and a circuit board containing at least one peripheral control chip

13. A modular wrist based device according to Claim 12 where said module could be a combination unit occupying two docking points on the modular strap and using at least one set of serial-bus connectors and being slid laterally into place as with a single module and preferably containing at least a display, interface device and control circuitry.

14. A modular wrist based device according to Claims 1-13 where at least one modular unit provides wireless communication such that any device on the strap can communicate wirelessly with an external device

15. A modular wrist based device according to Claims 1-14 where said demountable earpiece is comprised of an encased wireless connectivity chip and battery unit, with a collapsible earplug that is sprung and folds out as the earpiece unit is removed from a module attached to the strap, and can be re-collapsed by the action of re-attaching the earpiece to the module

16. A modular wrist based device according to Claim 15 where said earplug is formed from a flexible elastic or bi-stable that is biased towards a preferred curved deployed form that is more suited to being used within an ear, and a generally planar form when stored within a module on a strap

17. A modular wrist based device according to Claim 15 where a demountable wireless microphone is provided with an encased wireless connectivity chip and battery unit which can be stored on a module when not deployed.

18. A modular wrist based device according to Claims 1-17 where a connectivity module uses a sensor and display to indicate general electromagnetic signal strengths across a wide spectrum and frequencies, for mobile connectivity and general interest purposes

19. A modular wrist based device according to Claims 1-18 where a removable central control unit enables selection between available connectivity sources, and provides suitable Voice over IP, GSM, GPRS or 3G codec processing to manage packet based voice communication between the wristband and a base-station, and via the wrist band network, to provide audio feeds to a microphone and speaker located on strap modules, or via USB or Bluetooth wireless connectivity to local wireless audio devices.

20. A modular wrist based device according to Claims 1-19 additionally supporting a health sensor module where data is recording and transmitted wirelessly via a removable wireless module, to a nearby base station, to enable health monitoring and alerts

21. A modular wrist based device according to Claims 1-20 in combination with a docking station suitable for recharging the device and supporting additional electrically connected and spare modules

22. A modular wrist based device according to Claims 1 to 21 used in wireless combination with at least one module supported on a similar docking point on another wearable device such as a necklace, pendant, belt, cuff-link, button or glasses frame.

23. The ornamental design for a modular wrist based device according to Claims 1-22 substantially as herein described above and illustrated in the accompanying drawings

ABSTRACT

Abstract Title:
MODULAR WRISTBASED HANDSET WITH DEMOUNTABLE EARPIECES FOR VOICE OVER IP AND MOBILE COMMUNICATION

A modular wrist strap that is wearable as a wrist band and can be deployed as a handset suitable for mobile communication, supporting a plurality of electrically connected nodes that act as docking points to mechanically connect removable modules, thereby enabling easy module substitution for preferred or country specific connectivity, upgradeable data storage and battery modules, and personalisation of modules for consumer choice of features and ornamental style. Where said strap supports hub and host circuitry to enable network communication between modules and a universal connector plug for external recharging and data-exchange, and supporting a microphone and a speaker at alternate ends, suitable for communication use in the wrist or handset forms, and preferably supporting a module with demountable wireless earpieces. With said strap also supporting a generic electromagnetic signal sensor, to indicate availability of signals for general connectivity and interest purposes.

(Suggest use figure 4A as main drawing to accompany Abstract on first page)

Figure 1/10

Fig 1a

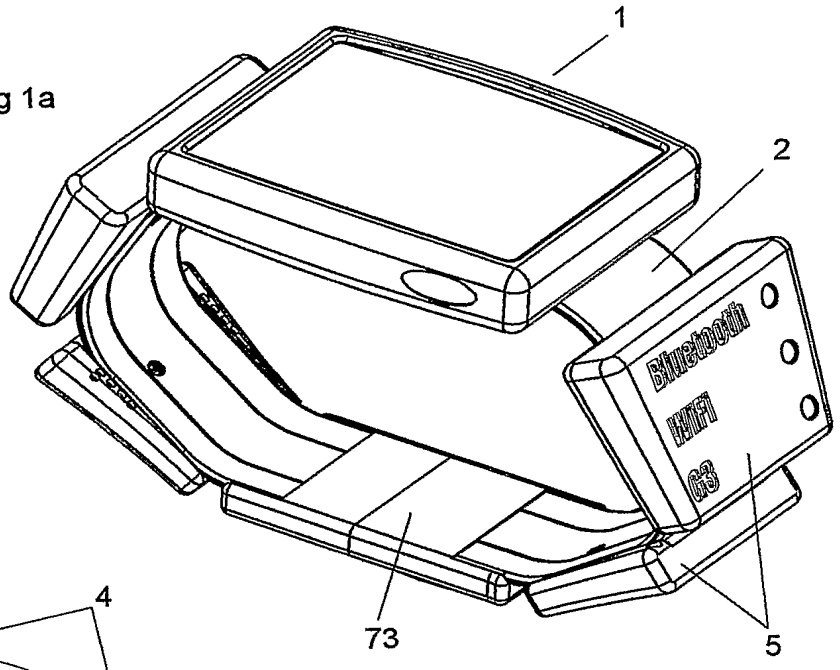


Fig 1b

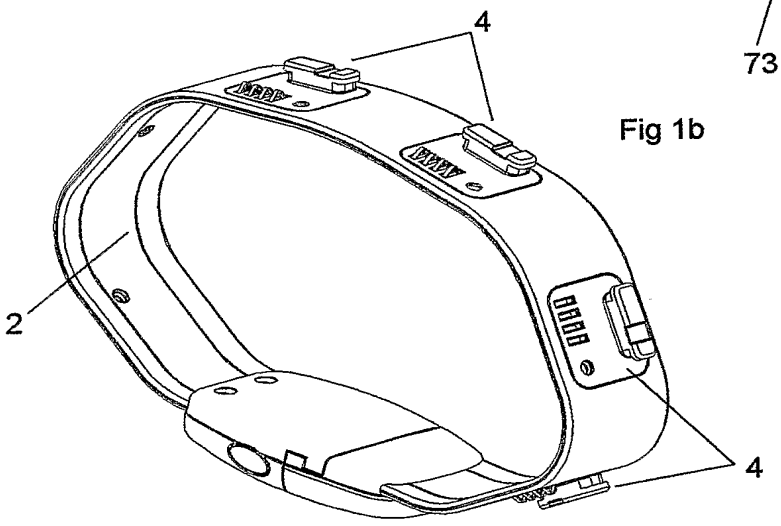


Fig 1c

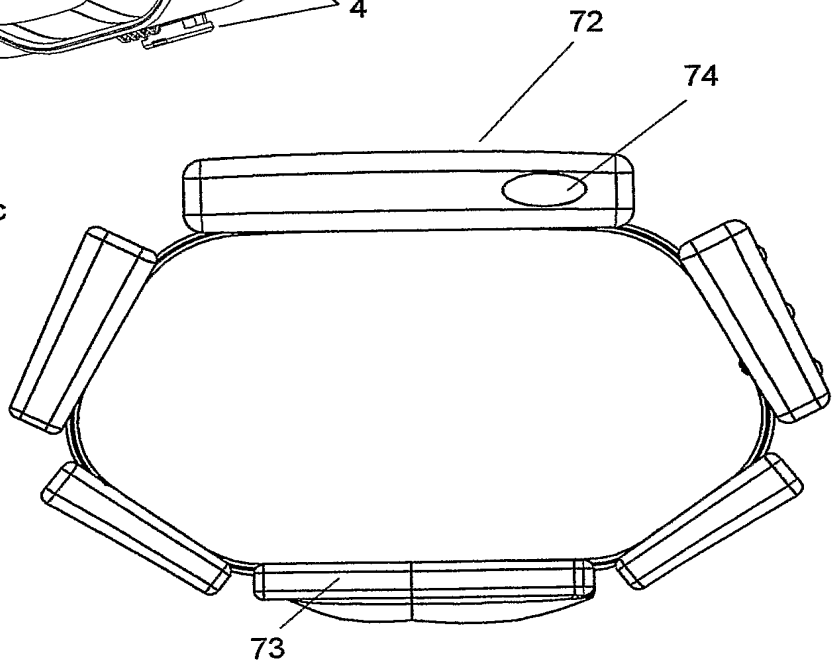


Figure 2/10

Fig 2b

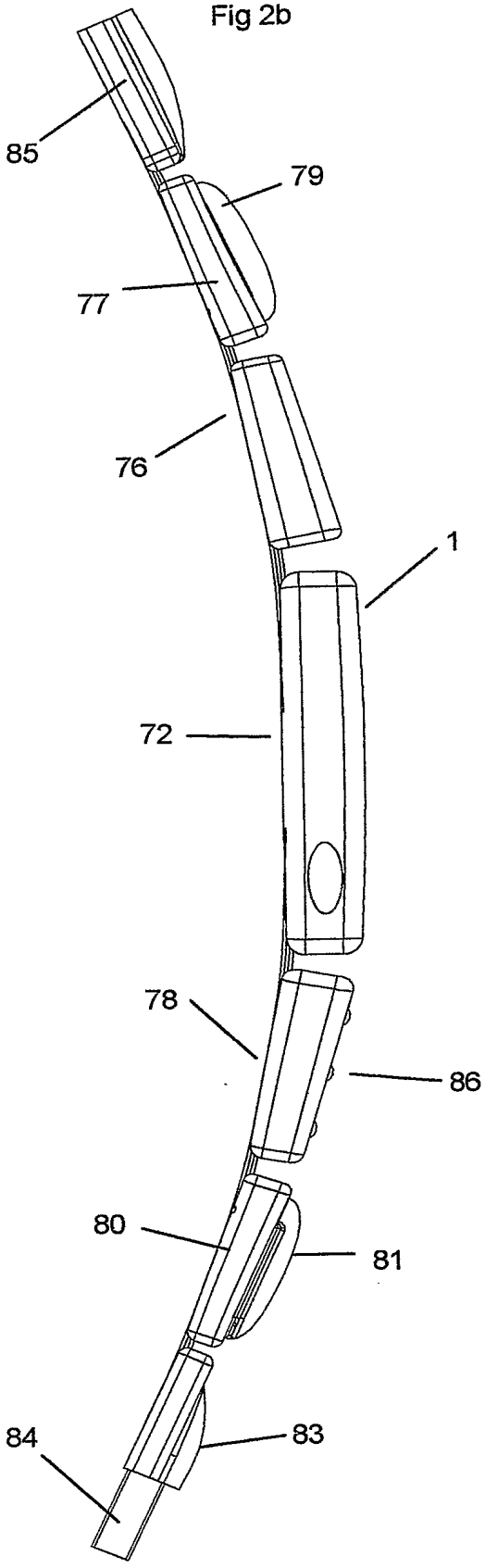


Fig 2a

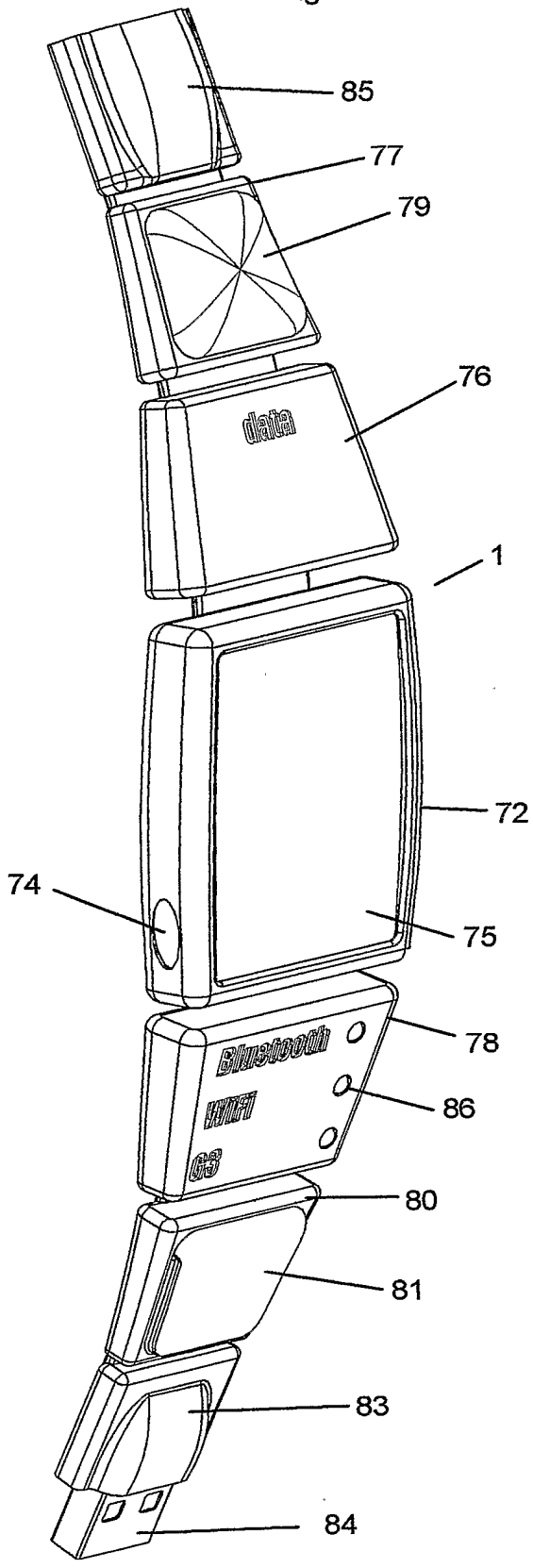


Figure 3a

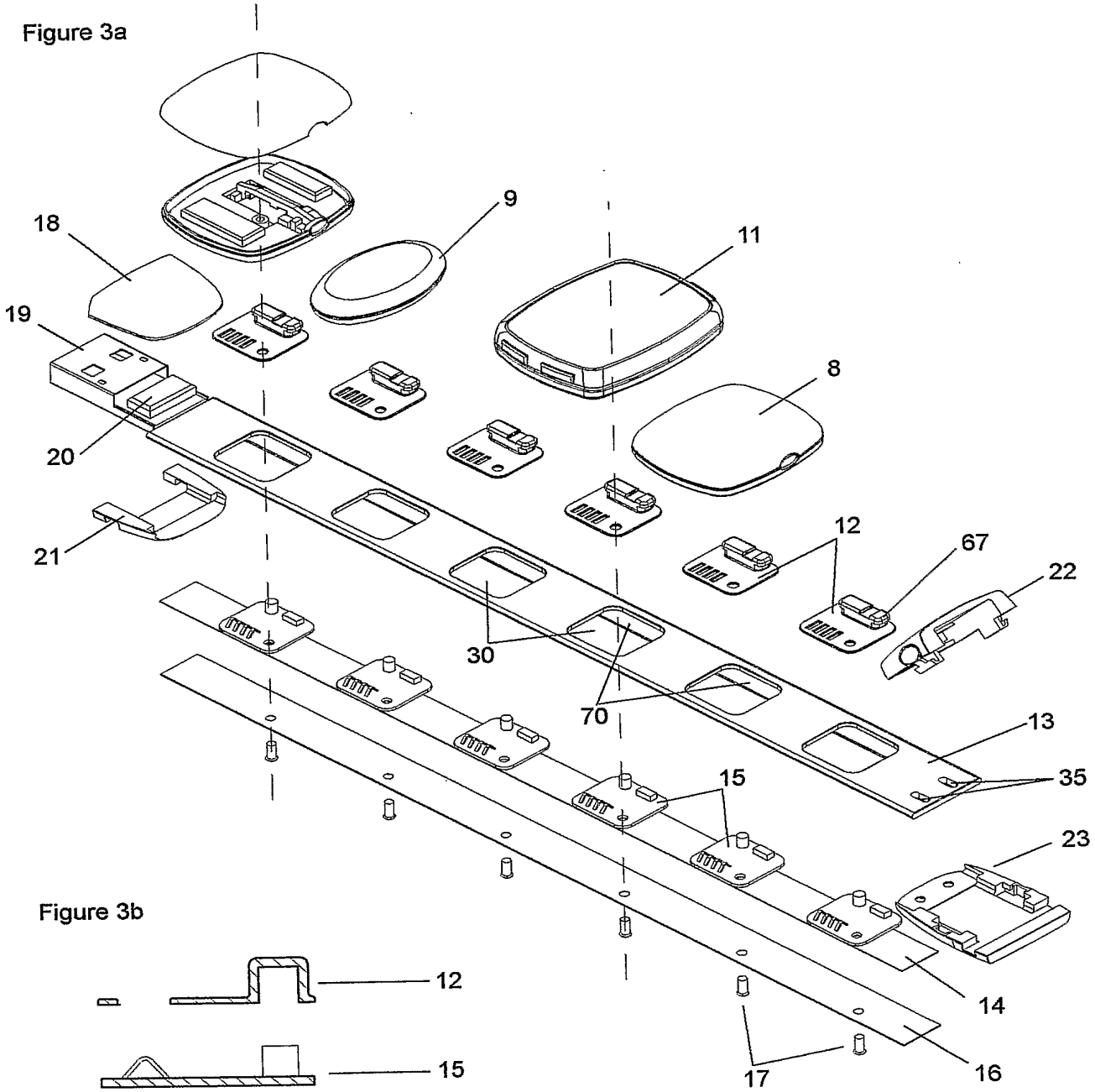
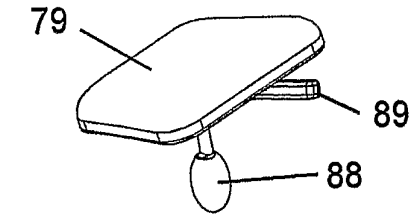


Figure 3b

Figure 4/10

Fig 4a



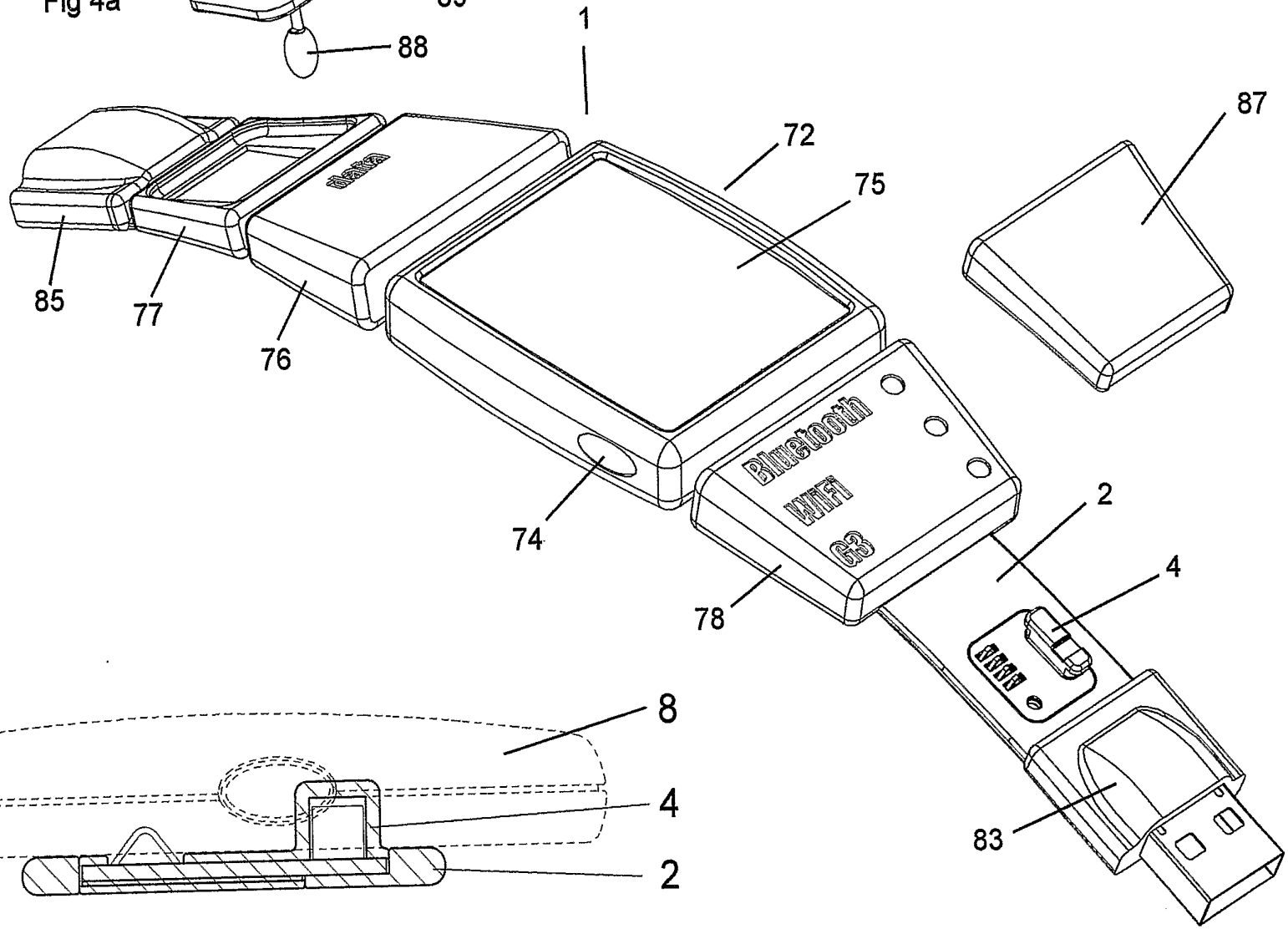


Fig 4b

Figure 5/10

Figure 6/10

Fig 6a

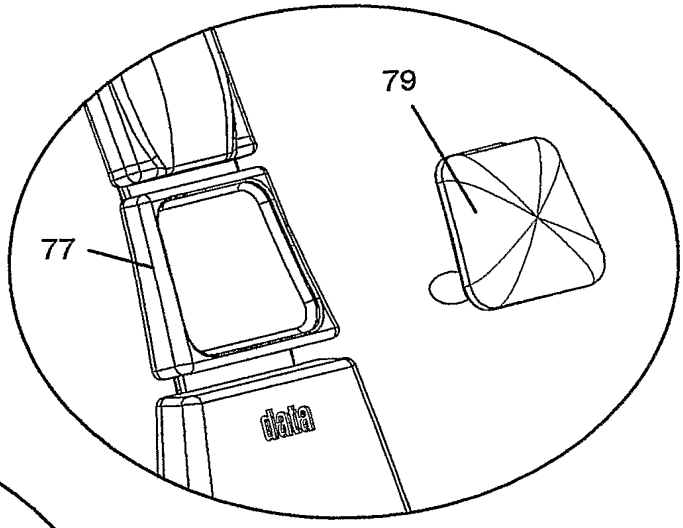


Fig 6b

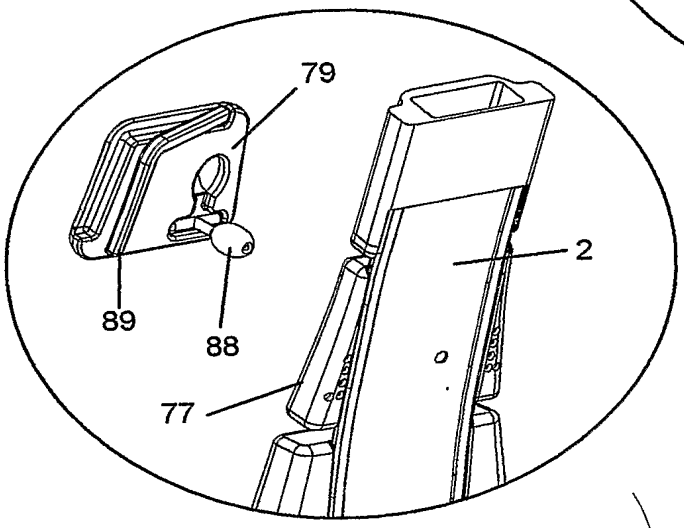


Fig 6c

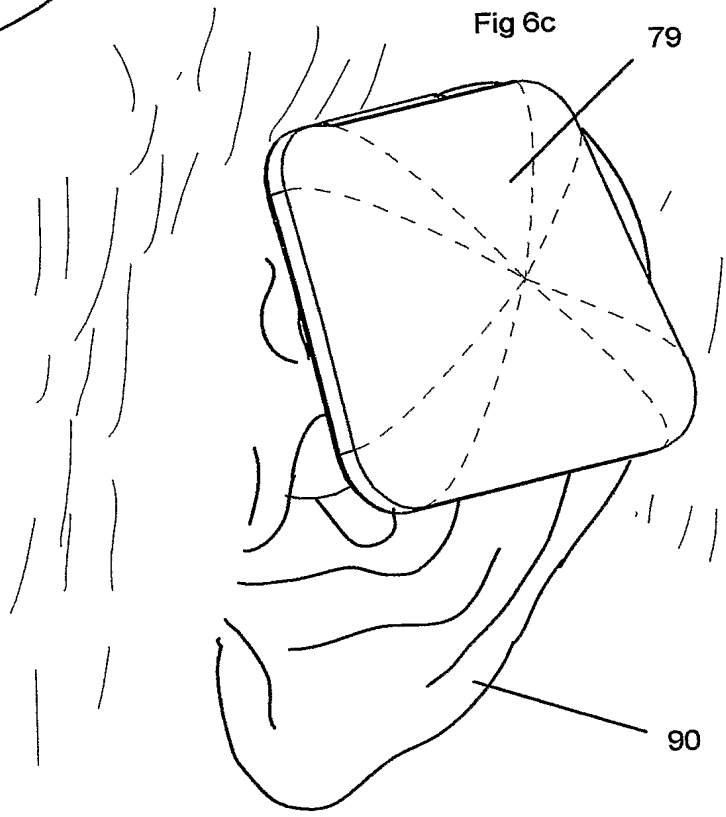


Fig 7a

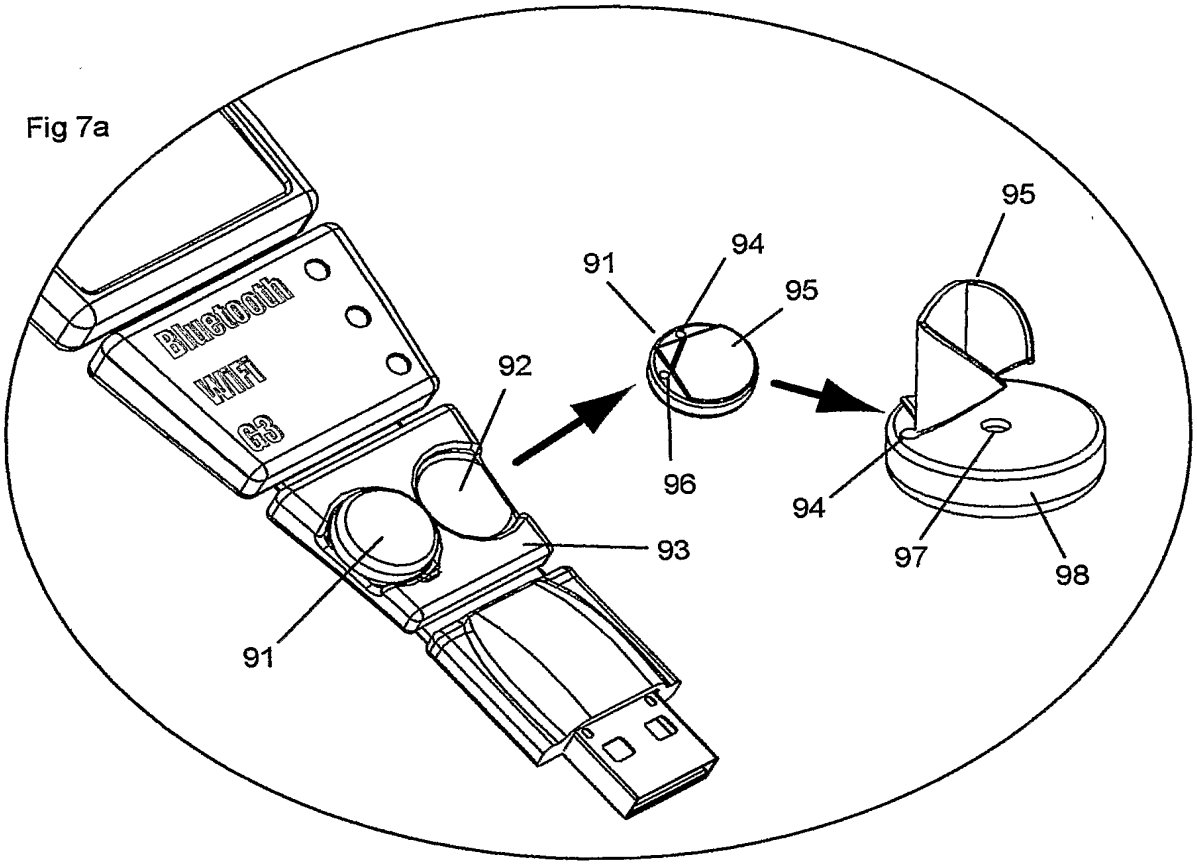
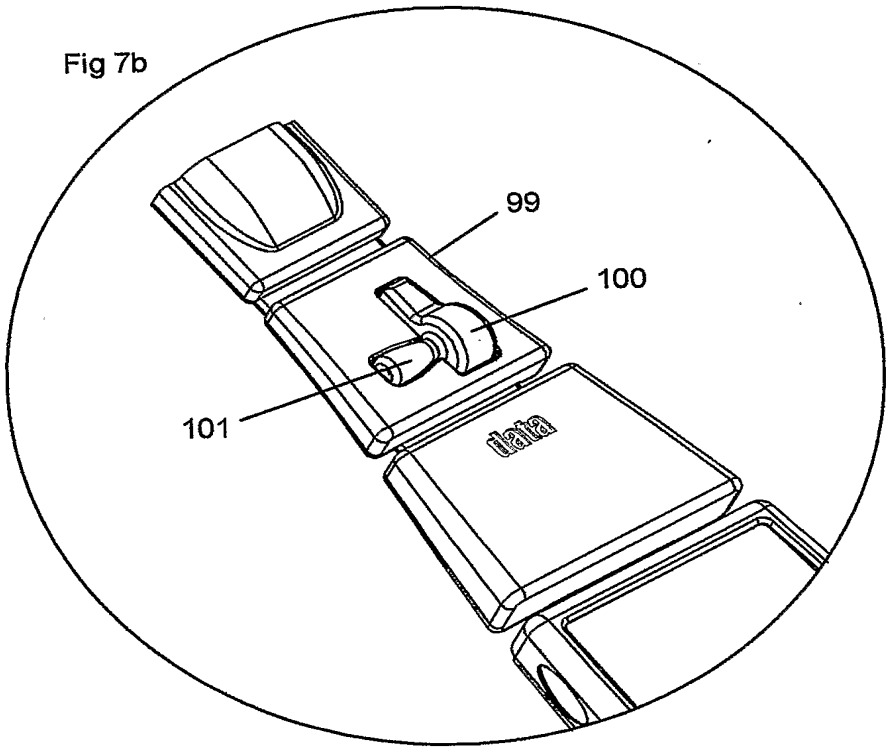


Fig 7b



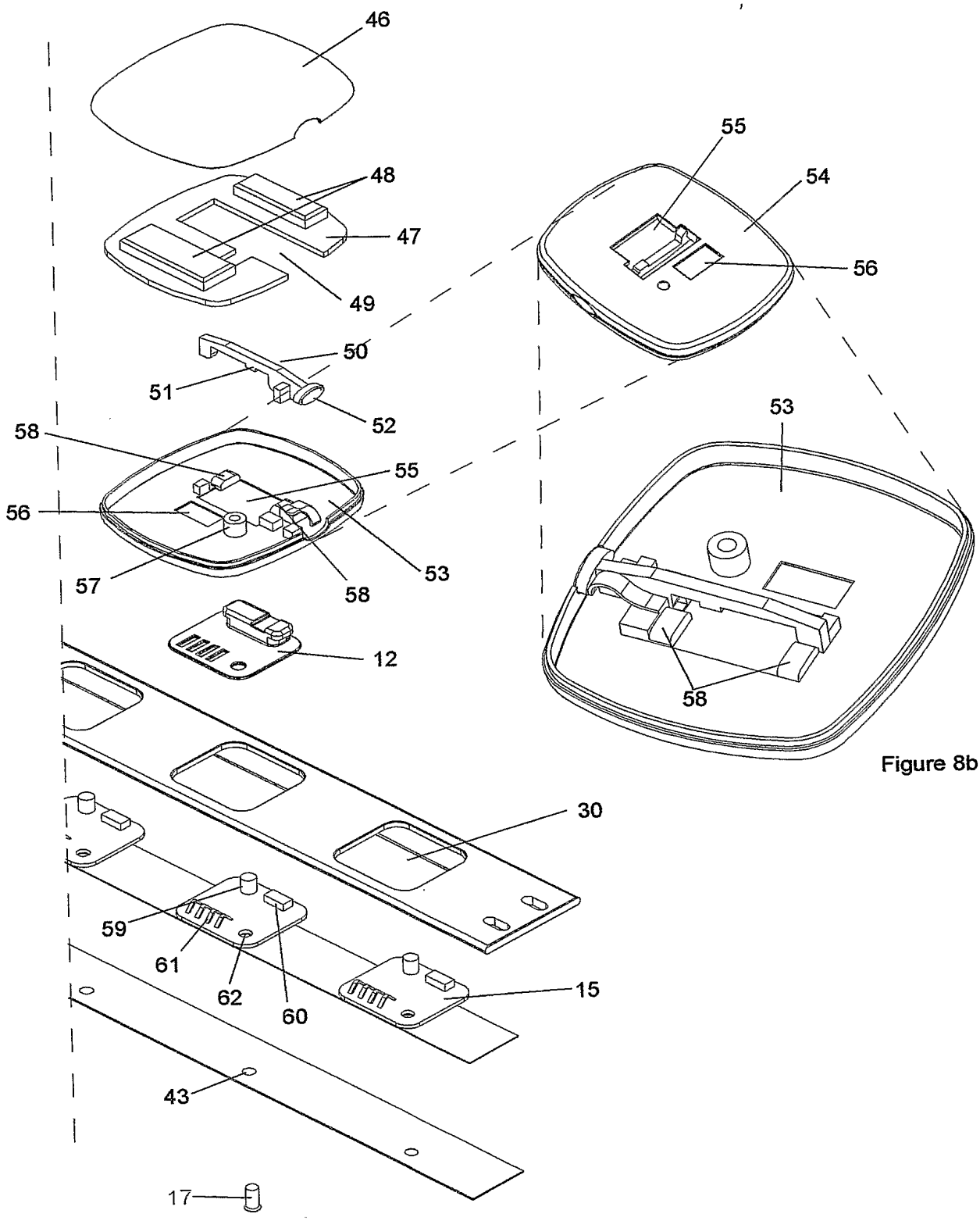

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Figure 8b

Figure 9/10

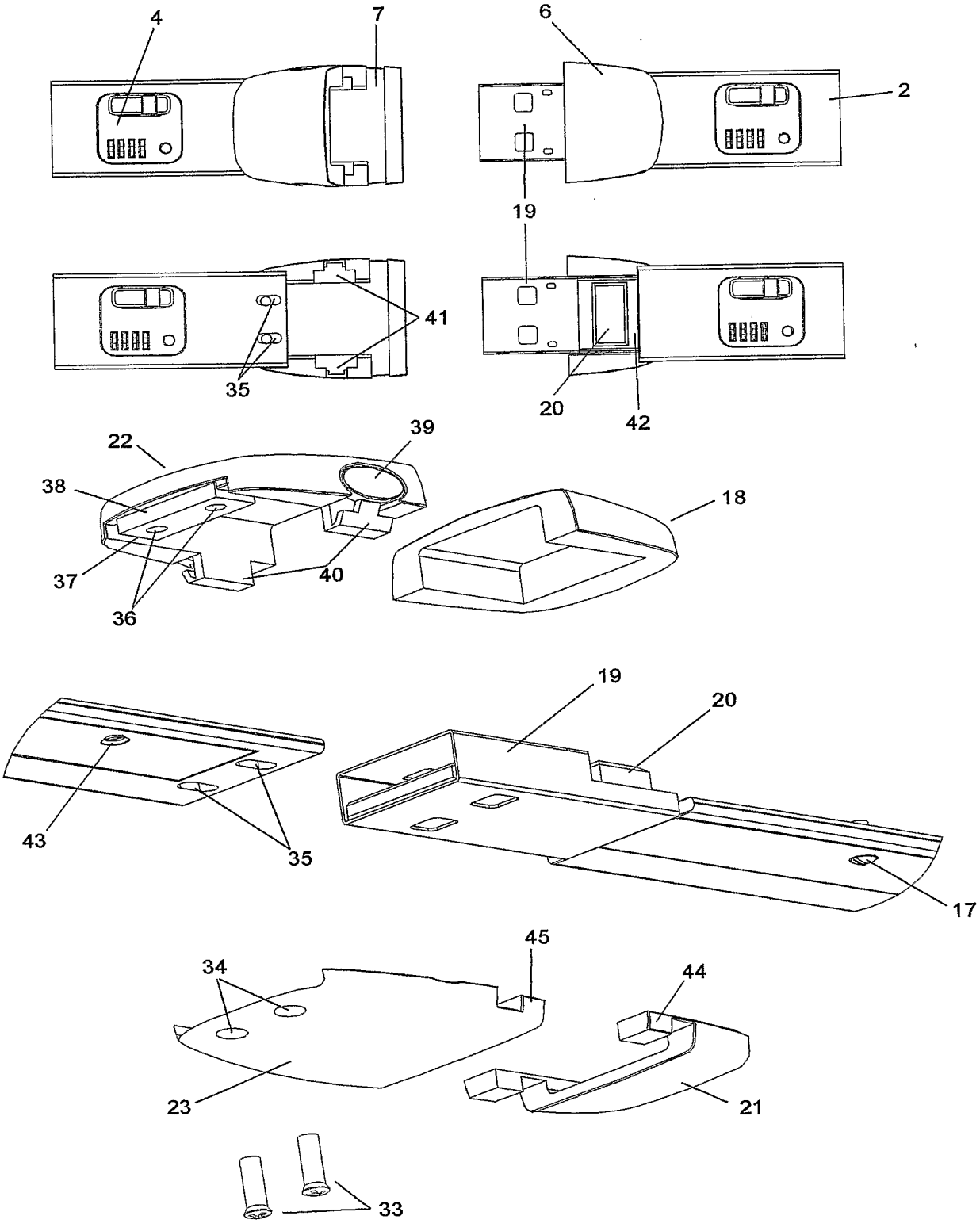
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Figure 10/10

Fig 10a

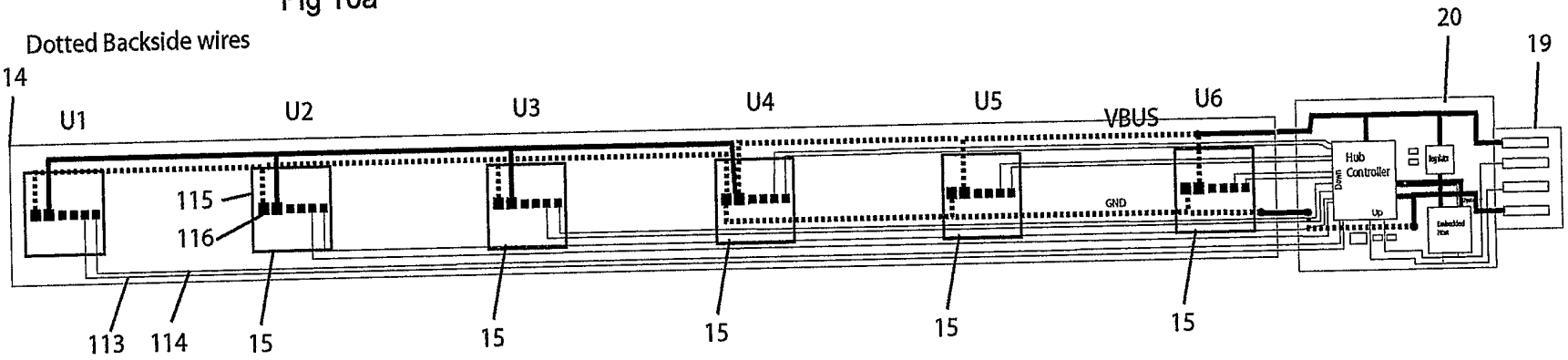

Fig 10b

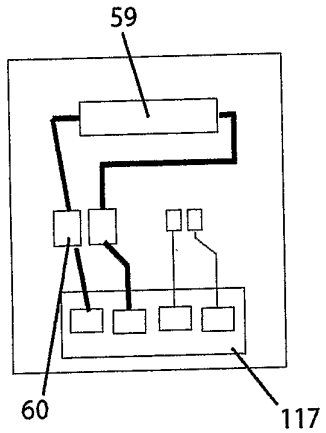

Fig 10c

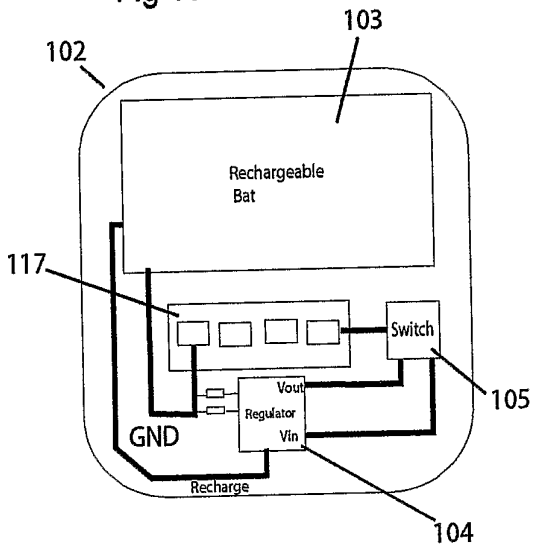

Fig 10d